A DOUBTFUL DEVELOPMENT OF LOCOMOTIVE ENGINEERING.

UNDER the heading of "A New Development of Economical Railway Haulage," the *Times* of February 13 tells us that "we are on the eve of a mechanical revolution such as has never been seen since the introduction of steam," and enters in a general way into a statement of results said to have been obtained from an old Great Northern locomotive fitted with a new type of valve-gear, the use of which is said to reduce the consumption of coal nearly 50 per cent. and increase the hauling capacity of the engine considerably, when compared with a sister engine fitted with the ordinary gear and doing similar work.

Locomotive engineers are becoming accustomed to the rapid advances of electrical science, and seldom doubt what the electrical engineer may claim to have achieved; but with the locomotive things are different; the machine is not new, neither is the valve-gear; the coal consumption has been thoroughly tested and the various gears examined from every point of view, there being no particular variation of opinion as to the most beneficial distribution of steam in the cylinders.

For this reason it is extremely startling to be told that a modified valve-gear will reduce the fuel bill nearly 50 per cent. with an increased load, the boiler pressure being only 140 lbs. per square inch, considerably below the average working pressure of to-day.

The locomotive experimented upon was built in 1882, and was, therefore, of the late Mr. P. Stirling's design, a type of locomotive famous for having a very small boiler in proportion to the cylinder dimensions, and, therefore, one requiring to be forced to keep up the steam, the forcing being done by a very keen draught induced by a small blast-pipe; such engines are famous for throwing fire from the chimney-tops. Yet, besides claiming this abnormal economy, we are told that the exhaust is so soft that the question of fire-throwing is entirely got over and that spark arrestors may be considered things of the past—surely a wonderful result.

The article referred to fills a whole column of the *Times*, but we may be allowed to doubt the results given, for although the name of Mr. H. A. Ivatt, the locomotive engineer of the Great Northern Railway, is quoted more than once, the statements do not appear over his name, and until they do, locomotive engineers may be excused if they continue to hold adverse opinions. The economical working of the locomotive is no new study; it is in the hands of able men who, no doubt, would be highly delighted if they could clearly demonstrate a saving of 5 per cent. even over previous practice.

N. J. L.

NOTES.

SIR WILLIAM ROBERTS-AUSTEN, K.C.B., F.R.S., will deliver the tenth "James Forrest" lecture, on "Metallurgy in Relation to Engineering," at the Institution of Civil Engineers on Wednesday, April 23, the date having been unavoidably altered from that originally proposed.

ARRANGEMENTS have now been made for Major Ronald Ross, Walter Myers lecturer in the Liverpool School of Tropical Medicine, to proceed for the third time to Freetown, Sierra Leone, on the work of the School. The expedition which he will rejoin is the fifth organised by the School, and went out early last year under Major Ross himself with Dr. Logan Taylor.

THE International Congress on the Methods of Testing Materials, held in 1900, decided to offer a prize of 3500 francs to the author who has made the most important contributions to the subjects for the advance of which the Congress was organised. The adjudication of the award of this prize has just been placed in the hands of the Comité des Arts mécaniques of the Paris Société d'Encouragement.

ARCHÆOLOGISTS and other students of antiquities will be glad to learn that it is proposed to obtain for Magdalene College, Cambridge, a copy of the head of Mr. F. C. Penrose, F.R.S., honorary fellow of the College, from the portrait painted by Mr. Sargent, R.A., for the Royal Institute of British Architects. The portrait will be presented to the College in recognition of Mr. Penrose's valuable services both to science and art. Among the supporters of the proposal are Dr. J. W. L. Glaisher, F.R.S., Sir R. C. Jebb, Prof. Liveing, F.R.S., Sir J. Norman Lockyer, K.C.B., F.R.S., Mr. A. G. Peskett and Lord Thring, K.C.B. Subscriptions are invited and should be sent (crossed Barclay and Co., Cambridge) to Prof. A. Newton, F.R.S., Magdalene College, Cambridge.

THE president of the Royal Geographical Society has made a special appeal to the fellows of the Society on behalf of the relief ship which must start not later than July next to obtain news of the *Discovery* and render assistance if necessary. It appears from the circular issued by the president that only 150 of the 4000 fellows of the Society have yet contributed to the funds for the relief ship. The council has, however, made itself responsible for the ship, which is now lying in the Thames and will shortly require to be furnished with stores and equipped with officers and crew. A spirit of loyalty should induce fellows of the Royal Geographical Society to provide the funds which will relieve the council of anxiety and ensure that essential precautions are taken for the safety of the members of the National Antarctic Expedition.

THE annual meeting of the Society for the Protection of Birds will be held on Wednesday, February 26, at the Westminster Palace Hotel, Victoria Street, London, S.W. The chair will be taken at 3 p.m. by Sir George W. Kekewich, K.C.B., secretary to the Board of Education. A proposal to establish a Bird and Arbor Day throughout the British Isles will be considered.

ON Tuesday next, February 25, Mr. W. N. Shaw, F.R.S., will begin a course of two lectures at the Royal Institution on "The Temperature of the Atmosphere, its Changes and their Causes." The Friday evening discourse on February 28 will be delivered by Prof. H. A. Miers, F.R.S., his subject being "Gold Mining in Klondyke," and on March 7 Prof. H. Becquerel, Membre de l'Institut, Paris, will deliver a discourse (in French) on "Radioactive Bodies."

A DISASTROUS earthquake occurred in Transcaucasia on February 13. Shemakha, the principal town in the area affected, has been completely laid in ruins, more than 20,000 people having been rendered homeless and 2000 lives lost. The first shock was felt about midday on February 13, and in a few seconds the Orthodox church, the mosques, the public buildings and hundreds of houses had fallen. The shocks were felt over a very wide area, and continued to recur during several days. A writer in the *Evening Standard* points out that in such a region as that affected the shocks may continue for a long time. To the north rises the great chain of the Caucasus, a region of crystalline and sedimentary rocks bent into great folds, not less remarkable than those in the Alps. In such a locality earth-tremors are at any time possible. In the latter chain no trace can be found of an extinct volcano, but Elbruz, the highest summit in the Caucasus, and Kasbek, which easily overtops Mont Blanc, are both ruined volcanic cones. Many more, though on a much smaller scale, are scattered over the region south of the Caucasus. In fact, signs of volcanic action are abundant over a very large part of the great upland plateau south of the Caucasus—the region where Turkey, Russia and Persia meet.

Ararat itself, though its crater has vanished, is an extinct volcano, for its rocks, where they disappear beneath the summit snows, are merely scoria. Some others, however, still retain their craters in a more or less perfect condition. A renewal of earthquakes and of volcanic eruptions, therefore, is not surprising. All the south of the Caucasus has occasionally suffered in this way. The neighbourhood of Ararat was severely visited in 1840; there was a bad earthquake in Asia Minor fifteen years later, and shocks are not infrequent in various parts of the region between the Black and Caspian Seas, the Eastern Mediterranean and the valley of the Euphrates.

Prof. E. C. Pickering has completed twenty-five years of service as director of the Harvard College Observatory; and we learn from *Science* that in recognition of this fact the staff of the Observatory has presented him with a silver cup.

Mr. Harry F. Witherby is about to leave England on a new ornithological expedition to Persia. It is Mr. Witherby's intention to penetrate the mountainous region north-west of Shiraz, after working the area between that town and Bushire.

The seventieth annual meeting of the British Medical Association will be held at Manchester on July 29, 31 and August 1. The president is Dr. G. B. Ferguson and the president-elect Mr. W. Whitehead. An address in medicine will be delivered by Sir Thomas Barlow, Bart., K.C.V.O., and an address in obstetrics by Prof. W. J. Sinclair. The scientific business of the meeting will be conducted in seventeen sections, which, with their presidents, are as follows:—Medicine, Dr. J. Dreschfeld; surgery, Mr. J. Hardie; obstetrics and gynæcology, Dr. D. L. Roberts; public medicine, Dr. J. Niven; psychological medicine, Mr. G. W. Mould; physiology and anatomy, Prof. Wm. Stirling; pathology, Prof. Sheridan Delépine; ophthalmology, Dr. David Little; diseases of children, Dr. H. Ashby; laryngology, Dr. A. Hodgkinson; otology, Dr. W. Milligan; navy, army and ambulance, Brigade-Surgeon-Lieutenant-Colonel G. S. Elliston; dermatology, Dr. H. A. G. Brooke; pharmacology, Dr. N. I. C. Tirard; ethics, Dr. S. Woodcock; industrial hygiene and diseases of occupation, Dr. A. Whitelegge; tropical diseases, Sir W. R. Kynsey, C.M.G.

A special committee of the Franklin Institute, Philadelphia, has reported in favour of the adoption of the metric system of weights and measures in the United States. The National Government is urged to enact such laws as will ensure the adoption of the system in its various departments, as rapidly as may be consistent with the public service. A number of questions have been discussed by the committee, and definite answers agreed upon. Thus, the opinion is expressed that no valid objection has been effectively urged against the metric system except that the numerator cannot be divided by two. A similar objection could, of course, be applied to the decimal system of currency in use in the United States. For convenient small units of everyday measurement, the millimetre is held to be better than either 1/16 inch or 1/32 inch, the latter being rather a fine subdivision for ordinary rough measurements. If the National Government can be induced to adopt the system in all its departments, it is believed that the adoption of metric measures throughout the country would follow within a reasonable time.

At the Imperial Institute on Monday, Dr. C. F. Harford-Battersby, principal of Livingstone College, gave a lecture on "The Obstacles to Development in West Africa." After referring to some of the minor impediments to West African development, a description was given of the discoveries which have recently been made with reference to the malaria question. It is now admitted by all malarial specialists that the mosquito is the means of communicating this, and some other diseases, to man. In this connection reference was made to Major Ross and also to Dr. Manson, under whose leadership the London School of Tropical Medicine has done such useful work, both in educating a large number of medical practitioners proceeding to different tropical climates and in various expeditions for investigating the subject of tropical disease. The Liverpool School of Tropical Medicine has also conducted a series of investigations into the subject of malaria on the west coast of Africa, and is now engaged in carrying through important sanitary operations besides education work in this country. Dr. Harford-Battersby referred to the instruction that is being given at Livingstone College to missionaries in questions of tropical hygiene and to the facilities afforded by the Travellers' Health Bureau, mainly by means of the quarterly journal *Climate*, to those who might desire information with regard to what precautions should be taken in entering a tropical climate. In conclusion, he hoped that the Governments of the different Colonies would take up in real earnest the sanitary measures necessary to carry into practical effect the important discoveries which have been made by scientific experts, and that the public generally would recognise the necessity of acting upon the recommendations which have been made as to protection from mosquitoes and would cooperate in carrying through adequate sanitary reforms.

We have received the *Annales* of the Magnetic Observatory of Copenhagen for 1897-8, of which Dr. A. Paulsen is director. The observatory is to be congratulated as being one of the very few institutions that publish magnetic observations in detail. The present volume contains hourly values of declination and horizontal force, and in addition the hourly and daily means have been computed, and the absolute extreme values are stated for each day.

During the past week most parts of this country have experienced severe night frosts. In the neighbourhood of London the thermometer has fallen as low as 14° in the screen, and 7° on the ground. In the midlands the readings have been considerably lower, and the exposed thermometer fell below zero. The temperature during February has not been so low since 1856, with the exception of three days in February 1895. The day temperatures have been low in most parts of the kingdom. On Sunday, with a maximum shade temperature of 35°, the solar radiation thermometer rose to 80° at Greenwich.

The Report of the Meteorological Council for the year ending March 31, 1901, has just been presented to Parliament. The Council has been reconstituted and now consists of five of the original members, who act as directors; these receive remuneration for their services. Five additional members have also been appointed by the Royal Society, among whom we are glad to see the name of Dr. R. H. Scott, who has been so intimately connected with the Office since its transference from the Board of Trade in 1867. Mr. Francis Galton, whose work was especially noteworthy in connection with the improvement of meteorological instruments and methods, and who first suggested the term "anti-cyclone," now so commonly used, has retired from the management on account of age. The superintendence of the supply of meteorological instruments for the use of the National Antarctic Expedition was undertaken by the Council, and after consultation with Sir G. G. Stokes, the Campbell-Stokes sunshine recorder was remodelled, to register during the twenty-four hours. Among the more important operations of the Council may be mentioned the arrangements for the investigation of the London fog, in cooperation with the London County Council, the establishment of observations at 7h. a.m. in connection with the German and Dutch Meteorological Offices, for the improvement of the telegraphic weather service, and the preparation of monthly pilot charts of the north Atlantic and Mediterranean, which have been frequently noticed in our columns. Arrangements have also been made, at the request of the United States Weather Bureau, for sending daily weather telegrams to Washington. The percentage of complete and partial success of the weather forecasts reached eighty-four, which is higher than that for any year during the last decade, except 1893, when the same high figure was attained. The success of storm-warning telegrams was 92 per cent.

A PAPER on wireless telegraphy is given by Prof. F. Braun, of Strassburg, in the *Physikalische Zeitschrift*, iii. No. 7. Without going into elaborate details as to the transmitter and receiver, it may be mentioned that the problem of resonance received careful attention in the construction of these apparatus, the desirable conditions being that waves of a certain frequency alone should be transmitted and received and that the receiver should be as sensitive as possible to these particular waves. The experiments were commenced by Prof. Braun at Strassburg in 1898; in 1899 they were continued at the mouth of the Elbe. Communication was set up between Cuxhaven and a lightship distant thirty-four kilometres. Later, messages were transmitted between Cuxhaven and Heligoland at a distance of sixty-five kilometres. It was thought possible that by means of an acoustical instead of a writing receiver, the distance from which messages could be received could be increased two and a half to three times.

IN connection with the campaign against hailstorms, Prof. V. Monti publishes in the *Bulletin* of the Italian Meteorological Office some statistics of the number of storms accompanied by snow at different stations, as recorded for the period 1881–1887 inclusive. The phenomenon of snow during thunderstorms is shown to be very rare in Italy, and in about one-fourth of the storms in which snow fell it was also accompanied by hail. When account is taken of the time of year as well as of the altitude of the station, it is found that in the majority of cases snowy thunderstorms occurred when snowy weather was the normal condition of affairs. There are but few records of snow falling out of season as a result of the sudden cold produced by thunderstorms. These statistics, so far as they go, are interesting as affecting the theory that by bombarding a thunderstorm the hail is transformed into snow. If snow frequently falls after a storm-cloud has been bombarded, and rarely under other circumstances, the theory in question obtains support. But, as Prof. Monti points out, we have not at present sufficiently complete statistics to enable any very definite conclusions to be drawn.

JUDGING from the capital figures which illustrate an article by "S" in *Globus* (Bd. lxxxi. p. 58) on the perforated landscapes of Kappadocia, that country must present a most remarkable appearance. In the district of the ancient Cæsarea-Mazaca, a plateau composed of a bed of tuff is topped by a layer of lava; denudation has resulted in broad cañon-like valleys, from the flat floors of which arise innumerable pointed sugarloaf shaped pinnacles. Many of these have been pierced and tunnelled for dwellings for ages past, and the caves are still being made. Some of the caves were used for religious purposes, and we have ruins of temples and of Byzantine churches carved out of the solid rock.

THE current number of *Man* contains several interesting papers. Prof. Flinders Petrie gives a plate illustrating two dozen hitherto unpublished prehistoric Egyptian figures of men and animals. The Rev. R. A. Gatty describes his finds of pigmy flints from Lincolnshire; perfectly similar flints have been found in various other localities in England, as well as in Belgium, in France, and in India. These problematical implements are of very delicate workmanship, but more information is required before any definite statements can be made as to their use or their users. Mr. Gatty believes that they were actually made at Scunthorpe in Lincolnshire from flint river pebbles.

DR. WALTER E. ROTH, the Northern Protector of Aboriginals, Queensland, has recently published his third *Bulletin* on North Queensland ethnography. The subject is "Food: its Search, Capture and Preparation," and there is no need to say more than that the facts are presented with that fulness of knowledge and concise detail that characterise all Dr. Roth's writings. As an example of this thoroughness it may be mentioned that Dr. Roth refers to some 240 plants which are used as food in some form or another, the scientific name of each plant being given. In addition to these, the natives know of twenty-two plants which they use to stupefy or poison fish. The plates illustrate the various kinds of baskets, nets, snares, &c. used by the North Queensland blacks. The only fault we have to find with this very valuable paper is its shape, but being a Government Report it is probably unavoidable that it is printed of Blue-book shape; this must be put down to the official mind and not to Dr. Roth. The *Bulletin* is marked C.A. 81—1901, Home Secretary's Department, Brisbane.

THE principal article in *Nature Notes* for February is one on the enemies of trout, by Mr. E. T. Daubeny.

IN the February number of the *Irish Naturalist*, Messrs. Mellard Reade and J. Wright describe the occurrence of marine boulder-clay in county Cork, with a list of the contained Foraminifera.

OWING to the roughness of the passage, which has to be made in an open boat, visitors to the little island of Bardsey, lying off the extremity of Caernarvon, are few and far between, and it is therefore a favourite resort for birds of many species. A list of the species met with during a visit to the island in May of last year is given by Mr. O. V. Aplin in this month's *Zoologist*.

THE history of the gradual diminution of the habitat in Britain of the swallow-tailed butterfly appears in the February number of the *Entomologist's Monthly Magazine*. At the present day this fine species is met with only in Wicken Fen and Ranworth and certain other Broads in Norfolk. Formerly, however, according to the author, Mr. C. W. Dale, it occurred in no less than fifteen other English and Welsh counties.

To the February issue of the *Entomologist*, Mr. W. J. Lucas contributes an account of the dragon-flies taken in Britain during the past year. Very interesting is the occurrence in Hampshire of the form known as *Oxygastra curtisi*, which has not been observed in Britain since 1882, when four specimens were taken at the same place. The author hazards some suggestions as to the breeding place of this rare insect in Hampshire.

IN a recent issue of the *British Bee Journal*, Mr. F. W. L. Sladen raises the question whether bees can hear. The author claims to have discovered that the so-called Nassanoff's organ—the membrane between the fifth and sixth dorsal segments of the workers—is really a scent-producing organ, and that this scent forms a means of communication between bees. He further suggests that bees have cognisance only of the well-known "hum," and do not recognise ordinary sounds.

THE second number of *The Emu* fully bears out the promise of its predecessor, and is illustrated by some excellent reproductions of photographs of Australian birds' nests. Perhaps the most generally interesting and important article is one by Mr. D. le Souëf, on protective coloration in Australian birds and their nests, which is to be continued later. In a second, Mr. J. C. M'Lean accounts for the appearance of the swamp-hen, or bald coot, in localities in New Zealand where it was previously unknown, by the clearance and drainage of many of its former haunts.

IN the Report for 1901 on the Lancashire Sea-Fisheries Laboratory at Liverpool and the Sea-Fish Hatchery at Piel, Prof. W. A. Herdman directs attention to the urgent need on the Lancashire coast of a special steam vessel for the purpose of scientific and statistical work. The Fisheries Branch of the Irish Agricultural Department has now such a steamer working under the direction of a scientific adviser; and if similar investigations could be undertaken on the opposite side of the channel, and the two vessels worked on a common programme, Prof. Herdman is of opinion that "this most definitely circumscribed area of the British seas would be adequately investigated." It is earnestly to be hoped that the necessary funds may be obtained without difficulty. The general work of the laboratory has been carried on with success. At the Piel hatchery attention was confined during the year to the flounder, but in the current year more attention is to be devoted to the incubation of the eggs of the plaice. Appended to the Report is an account of the morphology and life-history of the plaice, by Messrs. Cole and Johnstone, forming No. 8 of the *L.M.B.C. Memoirs.* This appears to be the most elaborate account of any single species that has hitherto been published, and reflects the greatest credit upon its authors, who have devoted two years to their task. The plaice, which is one of the most important of the British food-fishes, is a local and sedentary type on which the effects of excessive fishing would be almost sure to make them, selves felt, and it has been the subject of more than one Government investigation. The importance of a full knowledge of the structure and habits of this fish, such as the authors give us, can therefore, be scarcely overestimated. Much is to be hoped from the experiments in hatching and rearing the eggs and fry of the species alluded to above, for, as Prof. Herdman well observes, hatching and rearing are the real objects of institutions like the one under his direction, "And scientific men who have charge of fish-hatcheries will not be content till they have succeeded in rearing into young fish, at a reasonable cost, a sufficiently large proportion of the fry which they can now hatch from the eggs by the million."

WE have recently noticed Mr. D. G. Elliot's "List of the Land- and Sea-Mammals of North America," published at Chicago (NATURE, January 9). Since then we have received a copy of another work on nearly the same subject, prepared by Messrs. Miller and Rehn and issued by the Boston Society of Natural History. It is entitled "Systematic Results of the Study of North American Land-Mammals to the Close of the Year 1900," and embraces a larger area than Mr. Elliot's list, as it includes in North America the whole of the continent down to the isthmus of Panama and the West India Islands. It also serves to show, even more plainly than Mr. Elliot's list, the enormous additions lately made by the active zoologists of the United States to our knowledge of the North American mammal-fauna. Whereas Mr. True in 1885 only included about 400 species in his summary of this mammal-fauna, the authors of the present work enumerate no less than 1450 species and subspecies. Whatever may be the opinion of other naturalists about the status of some of these species and subspecies, all will allow that Messrs. Miller and Rehn have furnished us with a very useful summary of the results of the study of the North American mammals during the past fifteen years.

A WORK on "Meteorologische Optik," by Prof. J. M. Pernter, is in course of publication by Herr W. Braumüller, of Vienna and Leipzig, and the first part has been received. Prof. Pernter has given so much attention to the physical side of meteorology, and the analysis of optical phenomena, that his complete work ought to be of great interest. The part of the subject already treated is too general to admit of review, and we propose to defer our notice of the work until the whole of the parts have been published.

A SECOND edition of Prof. J. M. Coulter's inspiring little text-book entitled "Plant Relations: a First Book of Botany," has been published by Messrs. Hirschfeld Brothers. The chapters dealing with plant societies have been revised both in text and illustration, but otherwise few alterations have been made. As remarked in the review of the first edition (March 8, 1900, vol. lxi. p. 442), the book is an interesting and refreshing little manual, which ought to receive the attention of the teacher as well as the pupil. It should be of real service as a guide to nature-study.

WITH the laudable object of bringing science and scientific principles into every-day life and thought, a society has been formed and has issued a journal under the title of *Life.* The organisation at present has no name and its only designation is "our Society." A useful department of the journal is that in which advice is given as to the choice of books on various branches of science. There is an article on medical training and ideals, one on science and art in literature, and a third on the inaccuracies of the Old Testament—a subject which is perhaps better left alone by a society which hopes for success. The journal is edited by the secretary, Mr. R. A. Buddicom, 17 Craven Hill Gardens, Hyde Park, London, W., to whom all communications should be addressed.

THE *Transactions* of the Epidemiological Society (new series, vol. xx. 1900-1901) show that the Society is doing much to encourage the scientific study of disease. Dr. P. Manson, in a paper on some problems of tropical epidemiology, describes the work which has been done to establish the connection between mosquitoes and malaria, and suggests directions of further development. Why is it that Samoa, to take an instance, is free from malaria, while Mauritius has the disease present? The answer is probably that there is some organism in Samoa which is fatal to the malaria-bearing mosquito—Anopheles—while in Mauritius the insect can flourish; but the reasons for such differences are not clearly understood, and a systematic inquiry must be made before the conditions inimical to Anopheles can be exactly known. Similar remarks apply to diseases other than malaria; and Dr. Manson points out that expeditions to discover the causes and remedies of such diseases are even more necessary than expeditions to determine points of geological or geographical interest. Another paper in the volume is on plague in the nineteenth century, by Dr. A. K. Chalmers, who gives particulars of the outbreak of plague in Glasgow. Rats were plentiful in the affected houses, but they appeared to have escaped infection. Nearly three hundred rats were examined, but nothing suggesting plague was found. These results were in marked contrast with those described by Dr. Tidswell, of Sydney, at the close of Dr. Chalmers' paper. The facts obtained at Sydney showed conclusively that the plague was transmitted by fleas from infected rats. Among other papers we notice one on the diagnosis of plague, by Dr. E. Klein, F.R.S., which has already appeared in NATURE (vol. lxiv. p. 91); soil and typhoid fever, by Dr. J. T. R. Davison; and principles determining the geographical distribution of disease, by Dr. L. W. Sambon. A portrait of the late Prof. Max von Pettenkofer, of Munich, forms the frontispiece of the volume, and an obituary notice of this eminent investigator appears among the contents.

THE question of the nature of red phosphorus is one that has been frequently discussed, the general trend of the evidence being to show that red phosphorus is a polymer of white phosphorus. Some new and interesting experiments on this subject are contributed by Dr. R. Schenck to the current number of the *Berichte*. Starting with the well-known equation of van 't Hoff $-dC/dt = k.C^n$, in which C is the concentration, t the time, and n the number of molecules taking part in a reaction, he determines the velocity of transformation of white into red phosphorus in solution in phosphorus tribromide at 172° C. and 184° C., and finds that $n = 2$ is the only value of n which gives a constant value for k in the velocity equation. From this the conclusion is drawn that the equation $(P_4)_2 = P_8$ represents the first stage of the conversion of white into red phosphorus. It is, however, quite possible that this only represents the first stage in the process, the differences in the properties of the two varieties being so great that it is unlikely that they could be caused by such a small change in molecular weight.

AN important discovery in medical science is announced by M. Armand Gautier in the current number of the *Comptes rendus*. He has found that sodium methylarsenate, injected into the blood in minute amounts, is an absolute cure for malarial fever. Particulars are given of the treatment of nine cases, all of which had been contracted in Africa, and which were of such a severe type as to be refractory to large doses of quinine. The nine cases were rapidly cured, two only showing a slight relapse, and these yielded at once to a second injection. The progress of the cure was followed in each case by the examination of the blood, and the treatment was always followed by the disappearance of the specific hematozoa. The salt was also found to suppress entirely the anæmia associated with malaria. M. Gautier regards the results as sufficiently definite to authorise the substitution of this drug for quinine in pernicious malaria, although it still remains for further researches to determine the best dose, and whether administration by the mouth or hypodermically is to be preferred.

A COMPLETE index of the first thirty volumes of the *Journal de Physique* (1872–1901), arranged both according to authors and according to subject-matter of papers, has been announced.

THE behaviour of liquid sulphur dioxide as a solvent has been very completely investigated by Messrs. Walden and Centnerszwer, an account of whose researches is contained in vol. xxxix. of the *Zeitschrift für physikalische Chemie* (pp. 513–596). It is found that liquid sulphur dioxide easily dissolves a large number of (binary) inorganic salts and most salts of organic bases. The solutions of these salts are good conductors of electricity. The simple laws which regulate the conductivity of aqueous solutions of salts are in general not valid for the sulphur dioxide solutions. Amongst these may be mentioned Kohlrausch's law of the independent wandering of the ions, Ostwald's dilution law, the law according to which the molecular conductivity approaches to a maximum with increasing dilution, and the rule according to which the increase in the conductivity with the dilution is the same for all binary salts. The conductivity of solutions has been investigated at temperatures ranging from the freezing point of liquid sulphur dioxide to its critical point. The molecular conductivity increases at first with the temperature, reaches a maximum at a temperature dependent upon the nature of the dissolved salt, and then decreases with a further rise of temperature, becoming finally zero at the critical temperature, although the salts remain dissolved even at temperatures above the critical temperature. The authors conclude from this observation that electrolytic dissociation in solutions is an essential property of, or conditioned by, the liquid state of aggregation. Determinations of the molecular weight of dissolved salts by the boiling-point method give values higher than the normal, from which it would appear that the molecules of the dissolved salts are to a considerable extent polymerised, or form complex associated molecules containing molecules of the solvent.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Dr. Worley; a Pochard (*Fuligula ferina*), European, presented by Dr. H. S. Jameson; a Smooth-headed Capuchin (*Cebus monachus*) from South America, a White-fronted Capuchin (*Cebus albifrons*), a Hoary Fox (*Canis vetulus*) from Brazil, a Blue-fronted Amazon (*Chrysotis aestiva*), five Giant Toads (*Bufo marinus*) from South America, an American Green Frog (*Rana halecina*) from Central America, two Gangetic Trionyx (*Trionyx gangeticus*) from India, deposited.

OUR ASTRONOMICAL COLUMN.

THE NEW BRUCE SPECTROGRAPH FOR THE YERKES REFRACTOR.—This instrument has been provided from funds supplied in 1899 by Miss Catherine Bruce and the Rumford fund of the American Academy of Arts and Sciences. The arrangement of the various parts has been designed in view of obtaining the greatest possible rigidity and uniformity of temperature, as the principal work for which it is to be employed is the determination of velocities in the line of sight. To this end several departures have been made from ordinary designs. The foundation consists of two castings rigidly connected by a framework of steel tubes, one of these castings, weighing about 200 pounds, being attached to the massive terminal ring of the 40-inch refractor by eight bolts. The collimator tube is firmly attached to this and the second casting, which latter also holds the framework on which the prism train is mounted. It was decided to use three prisms of such angle that the total deviation was 180°, thereby rendering the instrument more compact and free from flexure. The optical train, consisting of the correcting lens, collimating lens, prisms and camera lens, were made by Brashear from formulæ supplied by Prof. Hastings. The correcting lens is 57 mm. aperture, and is so designed that when placed 100 cm. in front of the focus of the 40-inch for λ 4500, the angular aperture of the large lens is not altered. The performance of this lens has been found to be very satisfactory, rendering it possible to obtain a star spectrum of uniform width from λ 4300–λ 4700.

The collimator has a triple cemented lens of 51 mm. aperture and 958 mm. focus.

The first set of prisms, made from Mantois glass, was not satisfactory, and has been replaced by prisms made from glass supplied by Messrs. Schott and Co., of Jena. These are not perfect, but have given sufficiently good results to warrant their adoption. The refracting angles are about 63½°.

Two camera lenses are provided, one being a Zeiss anastigmat, aperture 71 mm., focal length 449 mm., the other a triple cemented lens designed by Prof. Hastings, with aperture of 76 mm. and focus 607 mm.

For the region of H_γ the dispersion of this spectrograph is almost identical with that given by the Mills and Potsdam III. spectrographs.

For temperature control the whole instrument is enclosed in a double-walled case of aluminium; thick felt is packed in the space between the two metal sheets, and a helix of thin wire distributed through this provides a convenient means of keeping the temperature of the prism chamber almost constant for a considerable time. For comparison spectra, electrodes of titanium and iron are used, and also a vacuum tube of helium.

In following, the method devised by Huggins of using the slit plate as a reflector has been adopted, several variations being made to avoid the inconvenience of having the two slit-jaws in different planes with respect to the collimator axis.

An extensive series of preliminary photographs has been taken and reduced, and the instrument is now in use for standard determinations of spectroscopic binaries, &c., which can only be detected by the variable radial velocity deduced from the displacement of spectrum lines (*Astrophysical Journal*, vol. xv. pp. 1–27).